SELF-SEALING MATTRESS STRUCTURE

Field of the Invention:

The present invention generally relates to a mattress structure, and more particularly to a mattress structure for hospital beds having a core with a plurality of self-sealing gas enclosures.

Background of the Invention:

Mattress support structures for health care applications, such as hospital beds, are generally provided with a mattress having air cushions. It is desirable to provide a mattress with air cushions that are as thick or tall as possible to provide maximum comfort and maximum mattress performance. The height of conventional air mattress are limited, however, by regulatory requirements relating to the minimum bed siderail height above the sleep surface of the mattress. In typical applications, the bed siderail height regulations effectively limit the overall mattress height to approximately six inches. A portion of this overall mattress height is used by a layer of foam or similar material placed on top of the air cushions. In health care settings, the use of sharp objects such as needles is common. As such, the mattress foam layer is desirable to protect the mattress air cushions from needle punctures and the consequent air loss of air cushions incorporated into the mattress.

Generally, the foam layer of conventional mattresses is approximately three inches thick, thereby reducing the maximum height of the air cushions to approximately three inches. This obviously reduces the performance of the mattress because the very thick foam layer attenuates the benefits that would otherwise be made available by a full height air mattress, without a foam layer. The expense for the air compressor, control valves, software, and hardware for operating the mattress are essentially fixed, regardless of the height of the air substrate. Thus, the reduced performance of the air substrate using a foam layer directly reduces the overall desirability of the mattress structure.

Accordingly, it is desirable to provide a mattress structure including air cushions that utilize the full height available under the applicable bed siderail regulations, but are resistance to punctures and air loss.

Summary of the Invention:

The present invention provides a mattress for a bed having siderails, including a relatively thin, non-puncture resistant cover having an interior surface, and a core

disposed adjacent the interior surface of the cover. The core includes a body that defines a plurality of gas enclosures with self-sealing characteristics. In one embodiment of the invention, the body includes a core that defines the plurality of gas enclosures that function as mounting locations for a plurality of self-sealing gas containers respectively disposed within the plurality of mounting locations. The core may further include an upper layer and a lower layer, connected together at a plurality of substantially parallel seams, thereby forming a plurality of substantially cylindrical mounting locations. The plurality of self-sealing gas containers, in this embodiment, may be formed as substantially cylindrical inflatable tubes, which are respectively disposed in the cylindrical mounting locations. The air containers may be pressurized by a gas source such as an air compressor. In the event of a puncture, the gas containers automatically re-seal as a result of the self-sealing material of the containers, thereby eliminating the need for a foam layer, and avoiding the loss of performance resulting from the use of a protective foam layer.

In another embodiment of the invention, the gas enclosures defined by the core body may include a self-sealing lining. In this embodiment, the core may also include an upper layer and a lower layer, connected together at a plurality of substantially parallel seams, to thereby form the gas enclosures. In the event of a puncture, the gas enclosure lining re-seals the gas enclosure, thereby eliminating the need for a foam layer and the associated loss of performance.

These and other features of the invention will become more apparent, and the invention will be better understood upon review of the following description of embodiments of the invention in conjunction with the accompanying drawings.

Brief Description of the Drawings:

Figure 1 is a partially fragmented, side elevation view of a prior art mattress structure supported by a hospital bed having siderails.

Figure 2 is a partially fragmented, perspective view of components of a mattress structure according to one embodiment of the present invention.

Figure 3 is a partially fragmented, perspective view of a component of a core body according to the present invention.

Figure 4 is a partially fragmented, perspective view of a core body according to one embodiment of the invention.

Description of Embodiments of the Invention:

The embodiments selected for description were not selected to limit the invention to the precise forms disclosed. Instead, the embodiments were selected to illustrate the concepts of the invention and to enable one of ordinary skill in the art to practice the invention.

Referring now to Figure 1, a conventional mattress structure 10 is shown situated on a conventional hospital bed 12. Mattress structure 10 generally includes an enclosure 14 having an upper, sleep surface 16, a lower surface 18, and defining an upper chamber 20 and a lower chamber 22. Chambers 20, 22 may be divided into a plurality of sub-chambers (not shown) by a plurality of interior walls (not shown). Upper chamber 20 is separated from lower chamber 22 by a dividing wall 25. In conventional mattress structure 10, upper chamber 20 contains a foam layer 24, and lower chamber 22 contains an inflatable layer 26. Foam layer 24 may include a plurality of foam cylinders or other shapes (shown as one solid foam piece in Figure 1). Similarly, inflatable layer 26 may include a plurality of gas containers, such as inflatable air bladders (shown as one air bladder in Figure 1).

Bed 12 includes a frame 28 having a support structure 29 including a mattress support surface 30. Frame 28 also includes a siderail 32. Siderail 32 includes a plurality of vertical and horizontal components 33 and an upper edge 34. As shown in Figure 1, siderail 32 extends from support surface 30 by a distance or height indicated by the letter "A." For a variety of reasons including patient safety, regulatory authorities require health care facilities and other similar organizations that use patient beds to maintain a minimum distance between upper edge 34 of siderail 32 and sleep surface 16 of mattress 10. This minimum distance is indicated by the letter "B." As should be apparent from the foregoing, the maximum height of mattress 10 is thus defined by the difference between distance "A" and distance "B" (indicated in Figure 1 by the letter "C"). As shown, a relatively large portion of the overall height of conventional mattress structure 10 is occupied by foam layer 24. Thus, in conventional mattress structures, the height available for inflatable layer 26 is greatly reduced by the use of foam layer 24.

Referring now to Figure 2, a mattress structure according to the present invention is shown and generally indicated by the numeral 50. Mattress structure 50 may include a top cover 52 and a bottom cover 54. Top cover 52 and bottom cover 54 may be connected together to define an interior region 56. Additionally, covers

52, 54 may be formed from an impermeable and wipable or cleanable material. It should be noted that top cover 52 does not include a foam layer or puncture prevention layer of any kind. Thus, top layer 52 is non-puncture resistant. As such, top cover 52 may be relatively thin.

Mattress structure 50 further includes a support core 58 and may also include a liner 60 placed over support core 58. Liner 60 may be formed of a shear, low friction material so that top cover 52 slides relatively easily over core 58. Core 58 generally includes a body 62 that defines a plurality of mounting locations 64. As will be further described below, in one embodiment of the invention, mounting locations 64 form enclosures 66 (Figures 3 and 4) which respectively receive a plurality of gas containers 68.

Referring now to Figure 3, body 62 generally includes an upper layer 70 and a lower layer 72. The upper layer 70 is connected to the lower layer 72 by a plurality of seams 74. Seams 74 may be formed, depending upon the materials used for layers 70, 72, using any of a variety of conventional techniques such as sewing, heat welding, etc. As shown in Figure 3, seams 74 of this embodiment are substantially parallel to one another thereby forming enclosures 66 as a plurality of substantially cylindrical spaces for receiving a plurality of gas containers 68 (best shown in Figure 4). While a variety of different materials may be suitable for forming body 62, in one embodiment of the invention, body 62 is formed preferably of substantially non-stretchable material such as a non-stretch fabric or non-stretch film material. Non-stretch fabric materials may include manmade or natural fibers (or a blend) that are woven, non-woven, or knitted. Non-stretch film materials may include manmade films and manmade, natural or blended scrim fiber. These materials may be constructed into, for example, scrim reinforced films or non-reinforced films. For example, a woven nylon twill material may be used. The type of material used should be sufficiently flexible to permit insertion and removal of gas containers 68, but also able to contain or reinforce gas containers 68 (which may otherwise flex or expand to a size beyond that defined by enclosures 66) to the dimensions defined by enclosures 66.

Figure 4 shows core 58 in a partially assembled state. As shown, gas containers 68A-D are inserted into enclosures 66 (gas container 68A is shown partially inserted). Additional gas containers 68 may be inserted into the remaining enclosures 66 to complete the assembly of core 58. Each gas container 68A-D is, in this embodiment, connected to a gas source (not shown), such as an air compressor or

pump. In this example, gas container 68A is connected by plumbing 76A to a gas source. Gas containers 68B-D are connected to one another and to a gas source by plumbing 76B. Thus, as shown in Figure 4, multiple gas containers may be connected together at various locations along the length of core 58. Each of these groups of gas containers 68 may be connected to a separate outlet of the gas source or through use of valves such that they are pressurized independently of the other groups. For example, gas container 68A may be pressurized to a higher pressure, thereby providing a stiffer portion of core 58, while gas containers 68B-D may be pressurized to a lower pressure to provide more cushion or give. Any combination may be accomplished by employing conventional plumbing or tubing. Thus, for example, the head portion of mattress 50 may be made firmer than the upper body portion of mattress 50.

It should be understood that while enclosures 66 and gas containers 68A-D are shown as being substantially cylindrical having an opening at one end, any of a variety of shapes may be used with single or multiple openings to receive gas containers 68. For example, core 58 may include a single enclosure 66 that expands the entire length and width of core 58, and encloses a single rectangularly shaped gas container 68. Alternatively, a grid of enclosures may be formed (square, rectangular, round, etc.) for receiving a plurality of similarly shaped gas containers. Moreover, enclosures 66 may be formed diagonally relative to the length and width of core 58 to receive gas containers 68 of virtually any shape.

In the embodiment shown in Figure 4, gas containers 68A-D may be formed from a visco-elastic sheet membrane, or other similar material having a self-sealing property. Such materials typically have a low tensile strength and are highly elastic, and thus may bend and stretch relatively easily. Accordingly, reinforcement is provided to gas containers 68A-D by the external sleeves formed by enclosures 66 at mounting locations 64.

In another embodiment of the invention, enclosures 66 may include self-sealing linings. More specifically, instead of gas containers 68A-D, the interior surfaces of enclosures 66 may be coated with a self-sealing material which renders the enclosure air tight and capable of resealing in the event of a puncture. In this embodiment of the invention, instead of including an opening 69 as shown in Figure 4, enclosures 66 are formed to receive a gas inlet which is connected through

associated plumbing to a gas supply. Enclosure 66 may be plumbed together in groups in the manner described above in relation to gas containers 68B-D of Figure 4.

The foregoing description of the invention is illustrative only, and is not intended to limit the scope of the invention to the precise terms set forth. Although the invention has been described in detail with reference to certain illustrative embodiments, variations and modifications exist within the scope and spirit of the invention as described and defined in the following claims.